March 3, 2006

Dan Landon, Executive Director
Nevada County Transportation Commission
101 Providence Mine Road, Suite 102
Nevada City, CA 95959

RE: ORIGIN DESTINATION LICENSE PLATE SURVEY

Dear Dan:

On December 06, 2005 (a Tuesday), Prism Engineering conducted a comprehensive origin and destination (O&D) survey using video and computer technology to capture license plate data during the pm peak hour.

Study Purpose

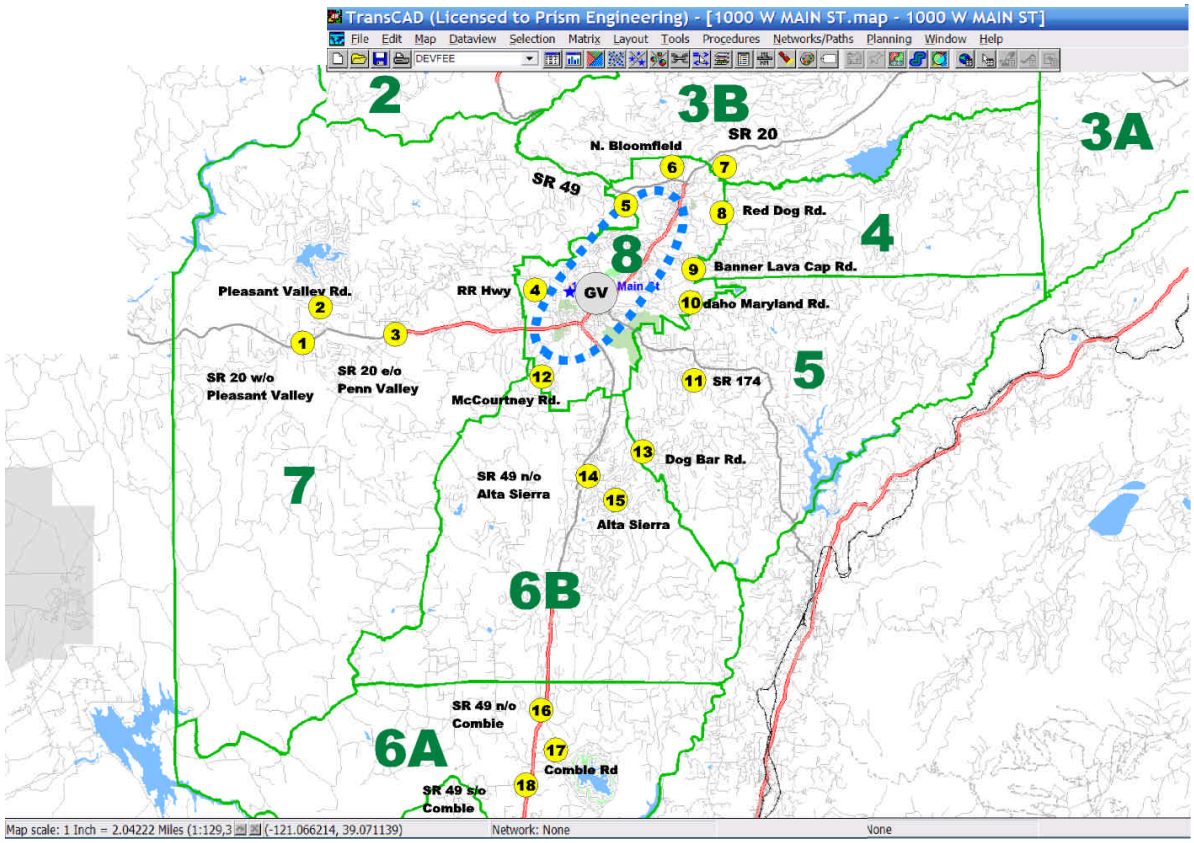
License plate surveys help to ascertain driver travel patterns from one part of the County to another. The NCTC Traffic Model is currently being re-calibrated using new software (TRANSCAD), and new traffic count and license plate O&D survey data. An Origin / Destination Survey helps prepare a better model, as driver behavior is studied and modeled in software.

Methodology

The methodology involved in this study was a three-step process; first, data collection and summary, second, data processing through customized software, and third, data results and conclusions. This process and its results are detailed in the paragraphs that follow.

The Data Collection Process

21 camera operators in the vicinity of 18 station locations (see Figure 1) surveyed license plates during the pm peak hour on Tuesday December 6, 2005.



LEGEND

Fee Zone Boundary

6B Fee Zone Label

Figure 1 Survey Stations within Fee Zones in Western Nevada County

Some locations such as Stations 3, 14, 16, and 17 had heavy two way volumes, and two video camera operators were employed at these locations (one for each direction of travel). The cameras used in this study were High-Definition and set at high frame-rates (sports mode) to capture the license plates of moving vehicles. All forms of safety were considered in preparation for this study. The 21 camera operators gathered thousands of license plates during the pm peak hour.

The Data Summary Process

The multiple videos from the survey were transferred into four computers for analysis. Using Macintosh video processing software, licenses were entered into a database using "freeze frame" techniques. Data transcribers entered tens of thousands of license plates into the database over a three-week period. A master spreadsheet was created with errors corrected for use as an input file to a custom software program.

Customized Software for Data Processing

PRISM Engineering developed custom software to find license plate matches for each of the 21 video survey tapes. Each individual license plate was cross checked with all other locations to find matches, and a tally of each match was summarized. A total of 900,000,000 "checks" were performed during the process. Figures 2 through 19 display the results of this process on a map generated from TRANSCAD GIS mapping software.

Uses of Data

The Results from this study will have many uses including the following:

- Update of mitigation fee schedule by fee zone after determining how much rural county traffic enters the Urban Fee Zone (Zone 8).
- Help determine distribution of trips from a directional vehicle count on a road segment.
- Update the traffic model to improve traffic assignment and trip distances, creating a better calibration of existing conditions and travel patterns.

Results

Table 1 documents the percentage of existing pm peak hour counts entering Zone 8. Using the information from this survey and existing pm peak hour counts at 14 of the "inbound" 18 survey locations, a percentage of Grass

Valley-Nevada City (Fee Zone 8) bound vehicles was established for each survey location. It was determined that an average total of 85% of the trips originating in the rural areas and traveling towards Fee Zone 8 in Nevada County end up in Fee Zone 8. Specific percentages for each survey location are given in Table 1. Figures 2 through 19 display the results from this survey for each study location. The red values in these figures indicate the percent of vehicles that reach a particular location. Each location is labeled as either an "origin" (black) or "destination" (yellow).

Table 1
Trips Into Fee Zone 8 (URBAN AREA) From Rural County

Survey Location (inbound to Zone 8)	Applicable Fee Zone	Year 2006 PM Peak Directional Count (away from Zone 8)	Year 2006 PM Peak Directional Count (towards Zone 8)	Video Survey screenline trip percentage to Zone 8	Year 2006 PM Peak Trips inbound into Zone 8	Year 2006 PM Peak Trips Passing Beyond Zone 8	Average Percent of Total Fee Zone 8 Trips
3	7	969	699	87%	608	91	4.3%
4	7	554	266	93%	248	19	1.7%
5	2, 7	367	246	87%	214	32	1.5%
6	3B	87	88	86%	76	12	0.5%
7	3B	212	297	77%	229	68	1.6%
8	4	463	281	87%	245	37	1.7%
9	4	232	144	90%	130	14	0.9%
10	5	104	54	87%	47	7	0.3%
11	5	737	567	88%	499	68	3.5%
12	7, 6B	447	265	88%	233	32	1.6%
13	5, 6B	709	515	88%	453	62	3.2%
15	6B	352	219	70%	153	66	1.1%
16	6A	772	1255	83%	1042	213	7.3%
TOTALS		**6005 trips**	**4897 trips**		**4176 trips**	**721 trips**	29%

Source: PRISM Engineering

Some of the locations shown on Figure 1 are not included in Table 1 to prevent double counting of trips towards Fee Zone 8. For example, Location 3 includes all trips from Locations 1 and 2 since they pass through Location 3. Location 14 was not included in the table to allow results from Locations 15 and 16 to stand out without double counting the trips towards Fee Zone 8. Locations 17 and 18 were not included because of directional splits being high between Combie Road and SR 49 to the south (in other words, they are not necessarily directed towards Fee Zone 8), and because the totals are implicitly included in Location 16 (similar to Location 3). *Individual* summaries for all locations are depicted in Figures 2 through 19.

Table 2 has been prepared to help match destinations with trips originating in the rural areas of the County as well as within Fee Zone 8. Table 2 takes its data directly from ITE trip generation rates multiplied against known data such as parcels or acreages of existing development. Trips coming towards Fee Zone 8 were tallied, for both residential and non-residential trips. The origin-destination survey was used to help determine the trip distribution of these trips from the empirical field survey data.

Table 2
Fee Zone 8 (URBAN AREA) Inbound Attraction Trips in NCTC Model

Residential Trips	Workplace and Retail Trips	TOTAL
DU's in Fee Zone 8: 9,624 Avg Trip Rate: 0.79/DU Trips in Fee Zone 8: 7,654 Inbound Percent: 60[1]	Acres of Non-Residential: 428.7 Avg Trip Rate: 48.0/AC Non-Res Trips in Fee Zone 8: 20,583 Inbound Percent: 47%	Inbound Trips to Fee Zone 8
4,592	**9,602**	**14,194**

Source: NCTC Traffic Model and GIS System
Note: Factored to Year 2006 (1.5% growth/yr)
[1] Source: Institute of Transportation Engineers (ITE)

Table 1 shows that based on the origin destination video survey, there are 4,176 trips going into Fee Zone 8 from the rural county zone areas, and Table 2 shows that there are 14,194 inbound possible trip matches as calculated from the NCTC model within Fee Zone 8 for the Year 2006. Therefore, the rural county areas (Fee Zones 2-7) are generating 29% of the in-coming trips to Fee Zone 8. This conclusion is based on verifiable data such as:

- assessor parcel data
- existing traffic counts
- origin destination survey data as measured in the field
- pm peak hour inbound/outbound factors
- and validated trip generation rates from the model.

The NCTC's Regional Transportation Mitigation Fee (RTMF) report previously predicted that, over a 20 year period, 21% of trips impacting the capital improvement projects included in the RTMF program would come from locations outside of Fee Zone 8. This recently collected data could be used to support a change in the Fee to reflect the difference between the percentage of inbound trips calculated from ITE trip rates and the observed field survey percentages of trip distribution to Fee Zone 8 from rural areas. For example, the fees in each zone could be adjusted so that the total of fees from zones 2-7 is 29% of the "average" fee, rather than 21%.

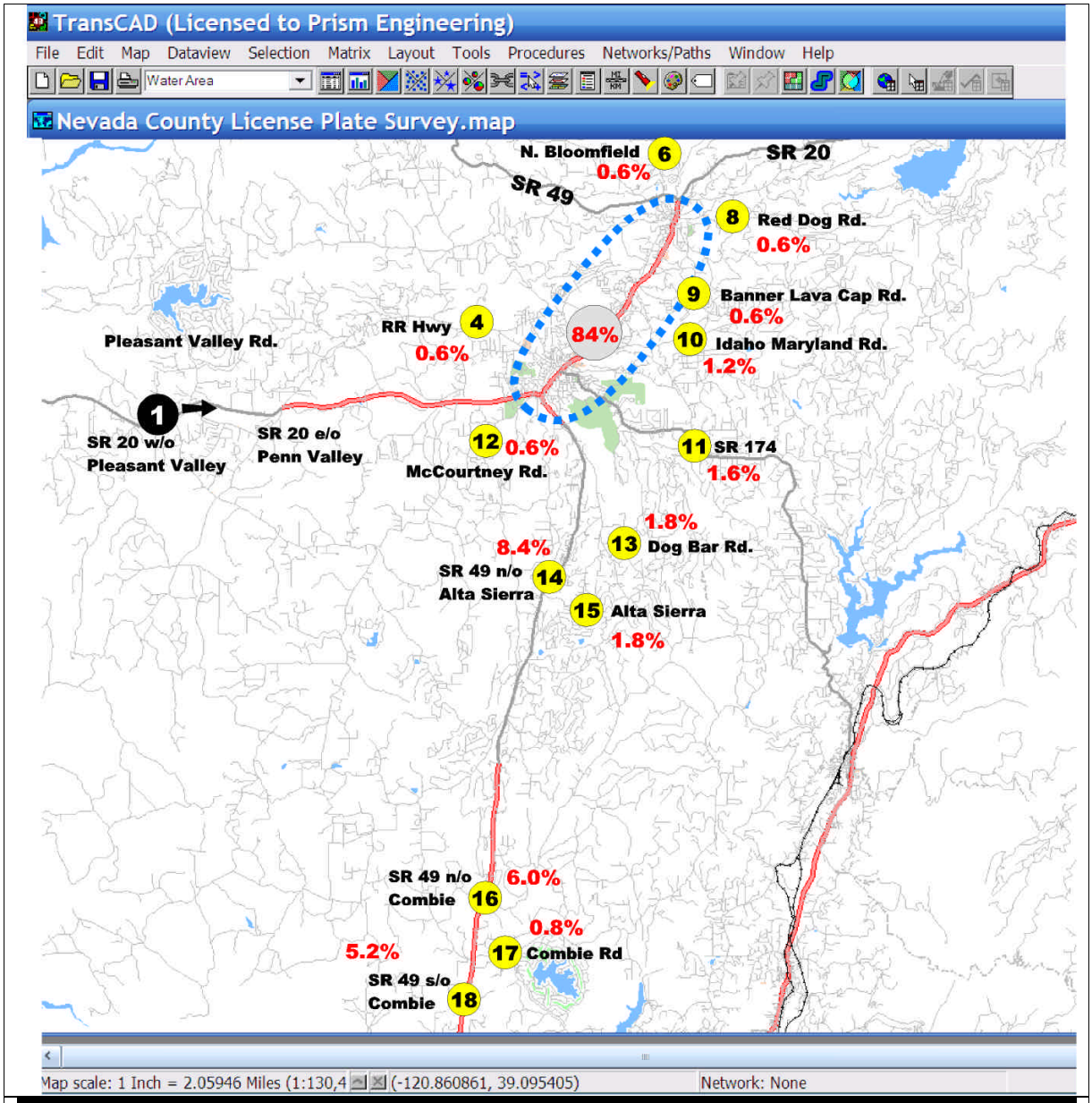


Figure 2 Survey Summary Station No. 1

A video camera operator captured license plate data for Survey Summary Station No. 1 along SR 20 at the intersection of Pleasant Valley Road, and was positioned just east of Pleasant Valley Road facing west. Both directions were captured. Location 1 and 2 feed into Location 3, which is reported in Table 1.

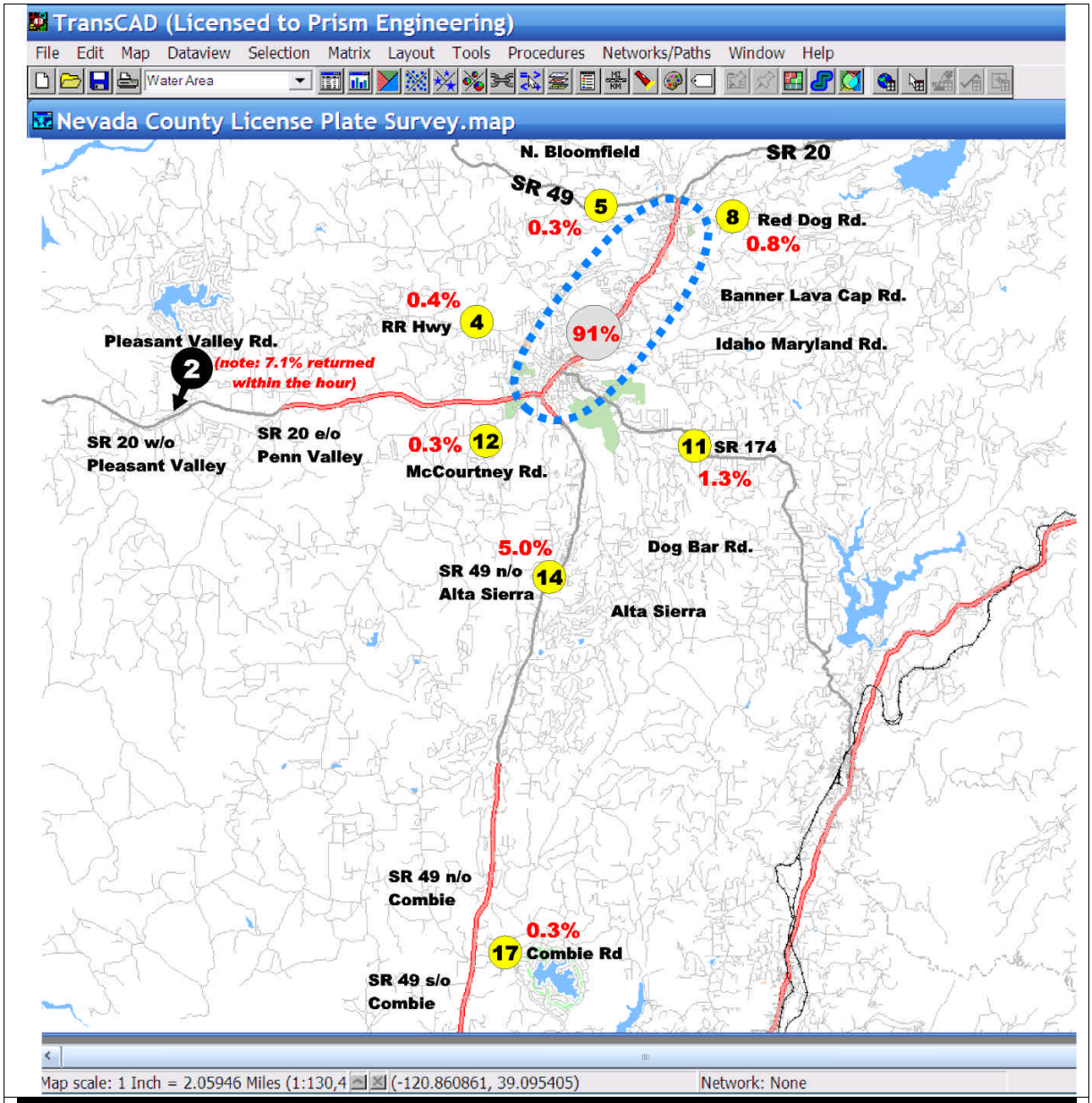


Figure 3 Survey Summary Station No. 2

A video camera operator captured license plate data for Survey Summary Station No. 2 along Pleasant Valley Road, and was positioned just north of SR 20 facing south. Both directions were captured. It was noted that 7.1% of the drivers heading out to SR 20 returned within the hour.

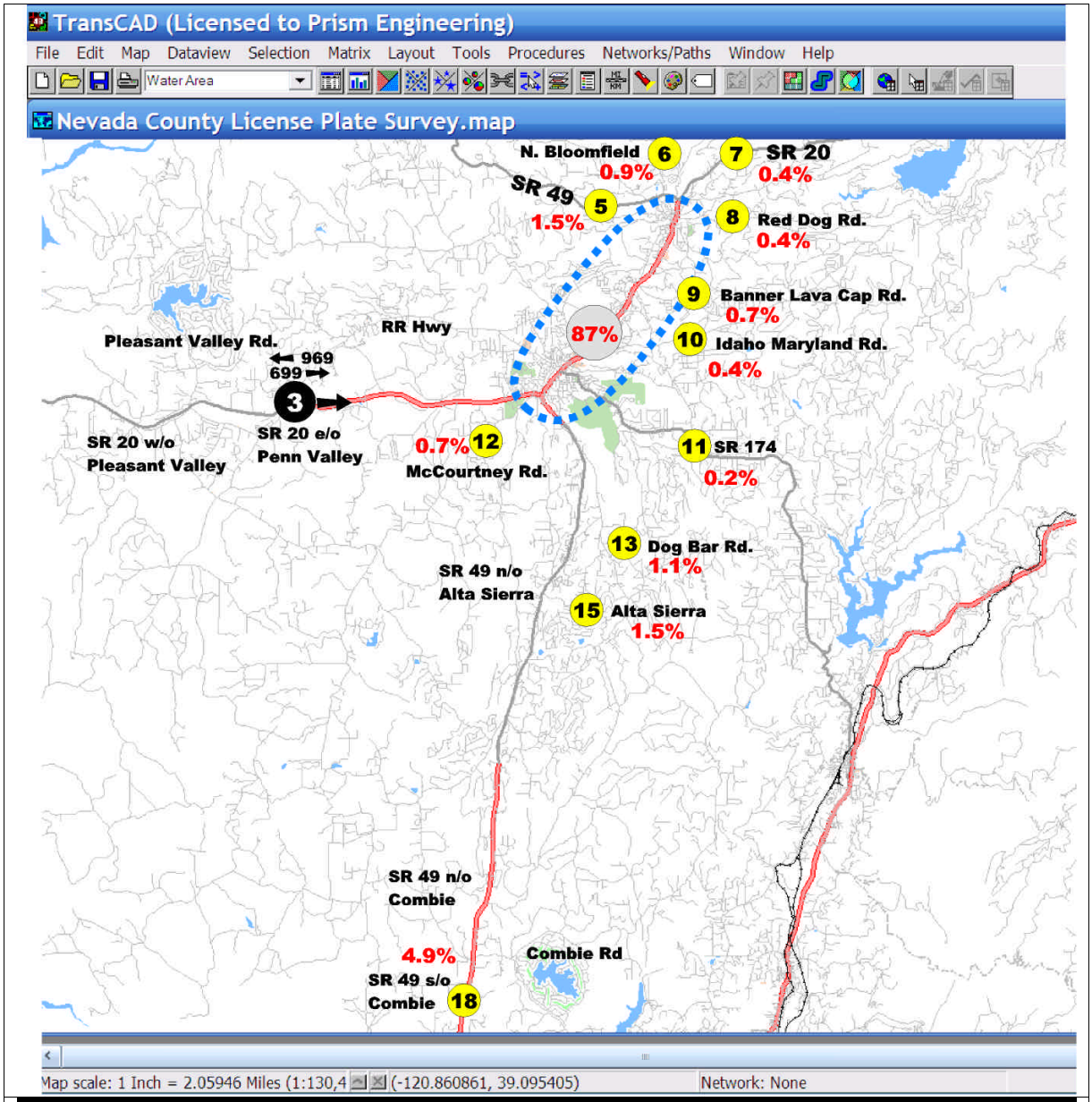


Figure 4 Survey Summary Station No. 3

Two video camera operators captured license plate data for Survey Summary Station No. 3 along SR 20 just east of Penn Valley Road. Both directions were captured. Average pm peak hour traffic counts show there are 969 vehicles heading west on SR 20 at the location, and 699 vehicles heading east towards Grass Valley.

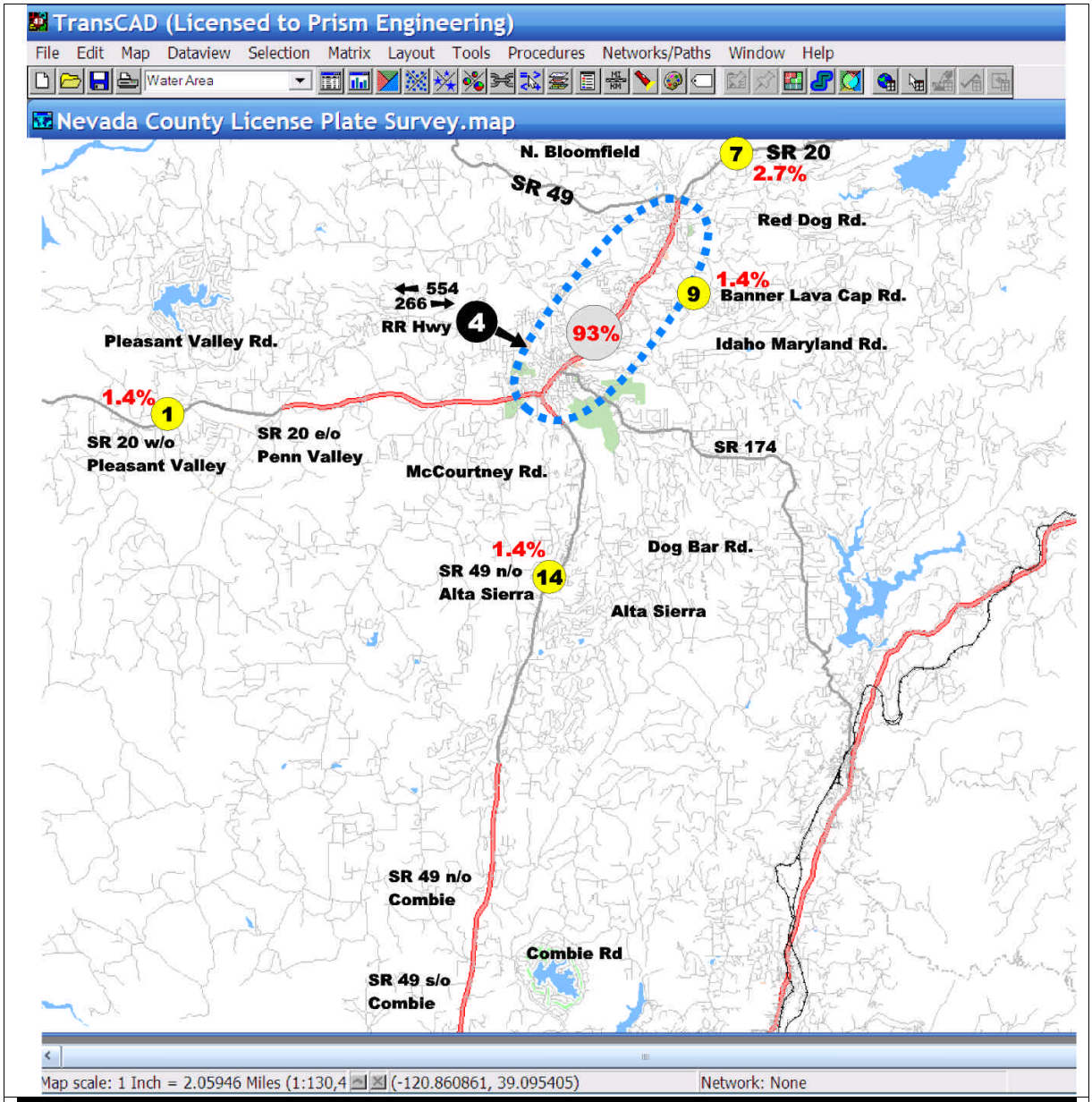


Figure 5 Survey Summary Station No. 4

A video camera operator captured license plate data for Survey Summary Station No. 4 along Rough and Ready Highway, and was positioned approximately 500 feet west of Ridge Road. Both directions were captured.

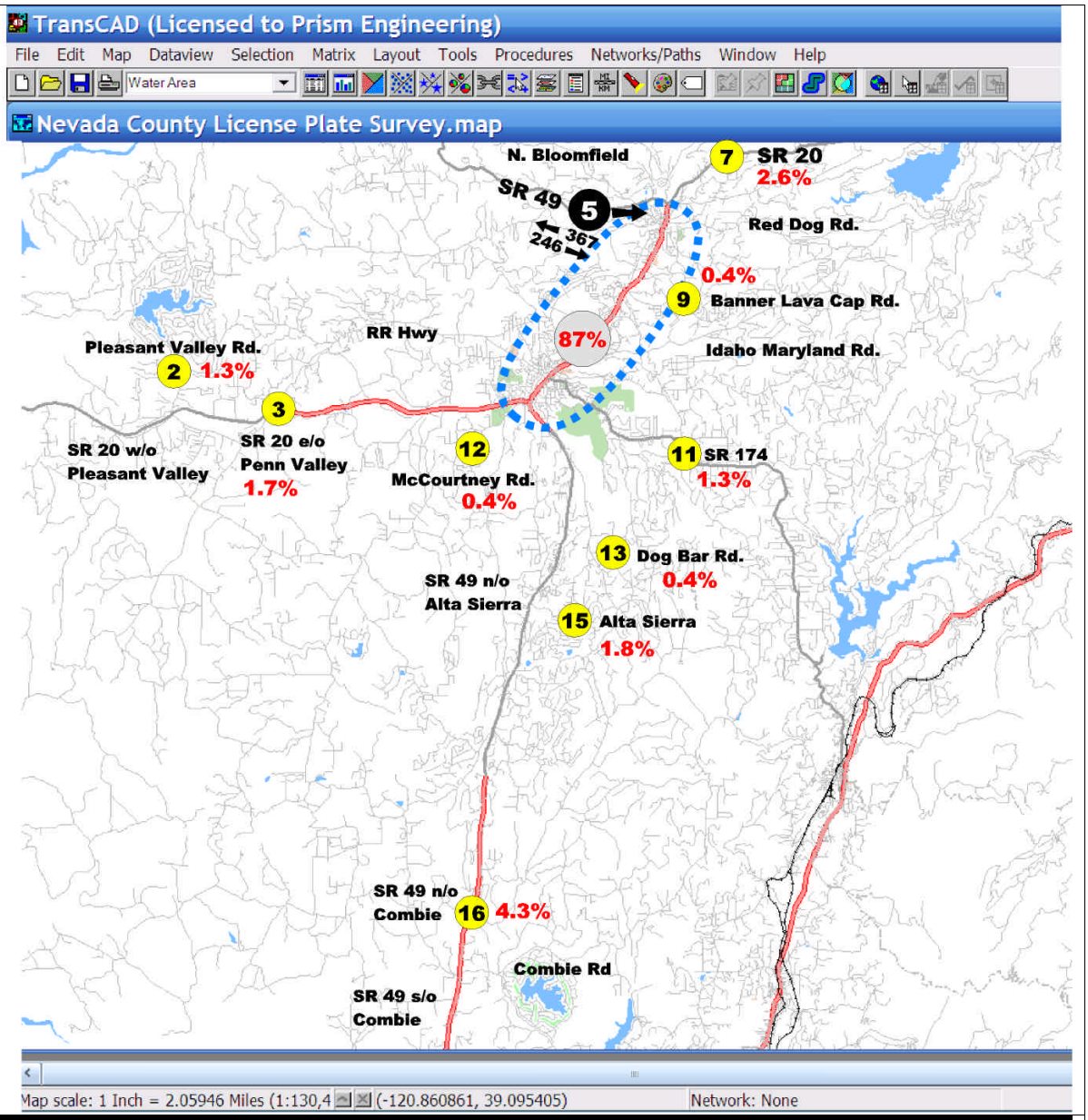


Figure 6 Survey Summary Station No. 5

A video camera operator captured license plate data for Survey Summary Station No. 5 along SR 49, and was positioned just west of Maidu Avenue facing west. Both directions were captured.

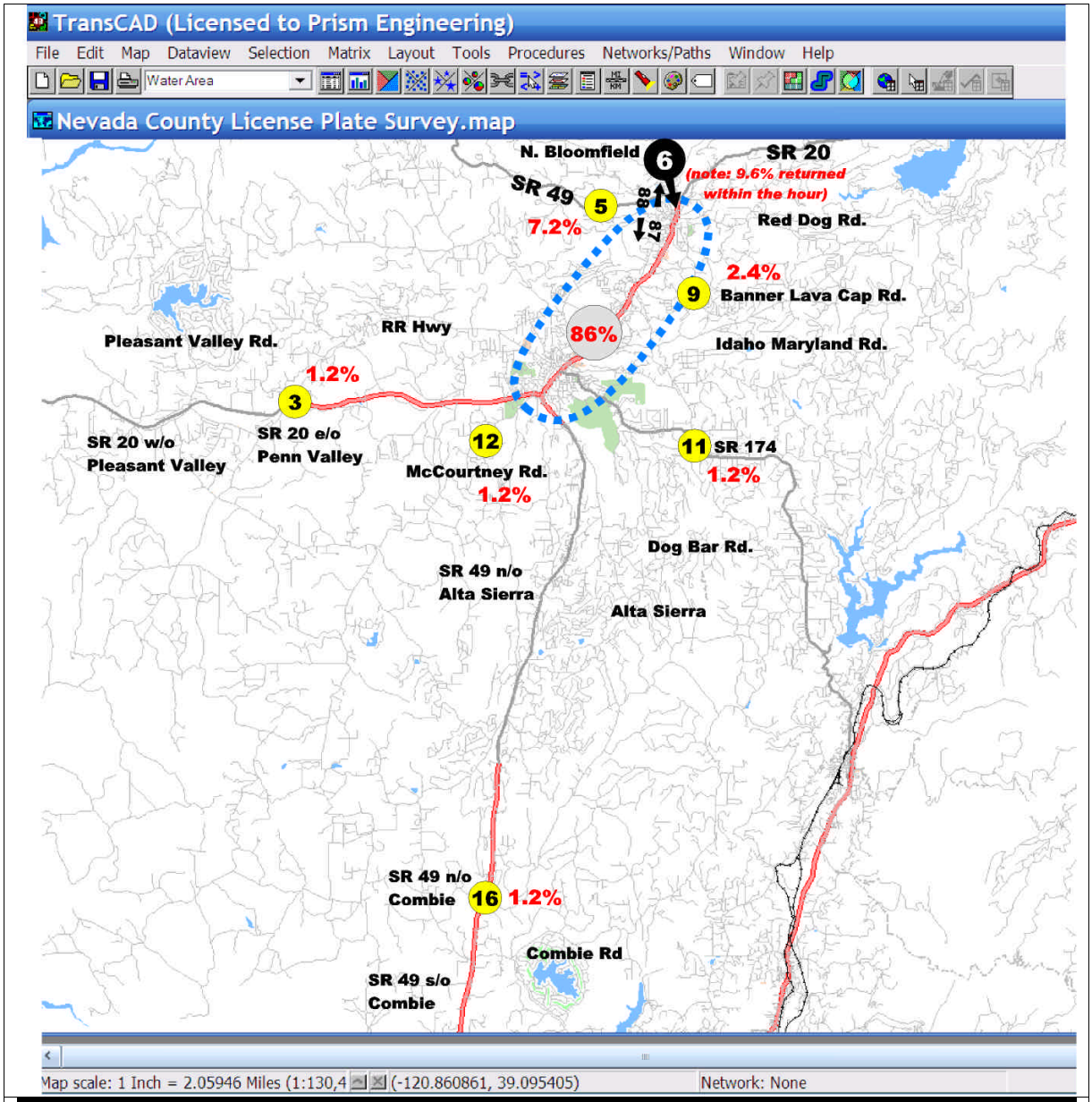


Figure 7 Survey Summary Station No. 6

While 86% of the trips from location 6 entered Fee Zone 8, it should be noted that 9.6% returned to location 6 within the hour. A video camera operator captured license plate data for Survey Summary Station No. 6 along N. Bloomfield, and was positioned just north of SR 49 facing south. Both directions were captured.

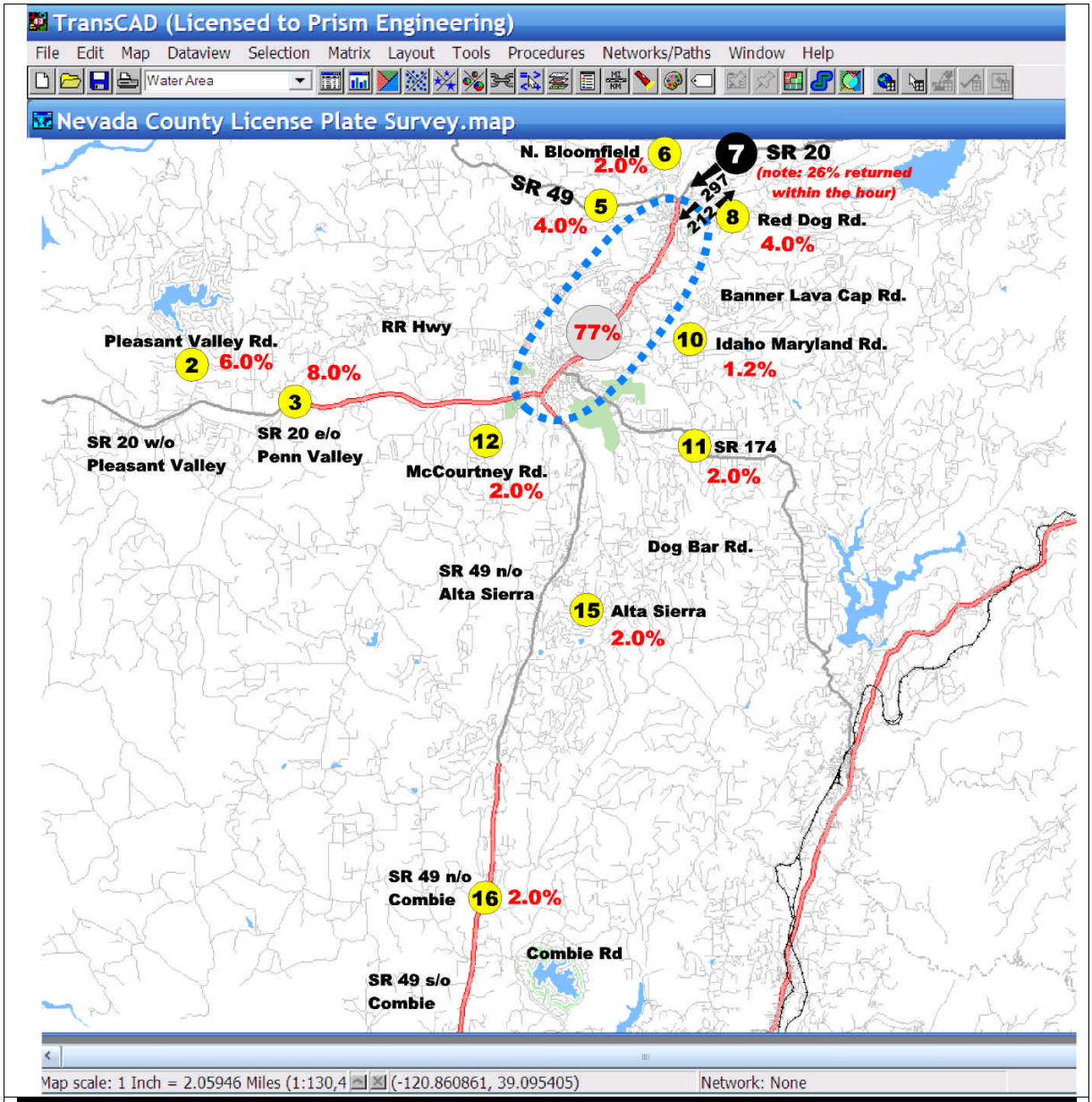


Figure 8 Survey Summary Station No. 7

A video camera operator captured license plate data for Survey Summary Station No. 7 along SR 20, and was positioned approximately 1000 feet north of SR 49/Uren Road facing south. Both directions were captured. 26% of the vehicles entering Fee Zone 8 from this location returned to station 7 within the hour.

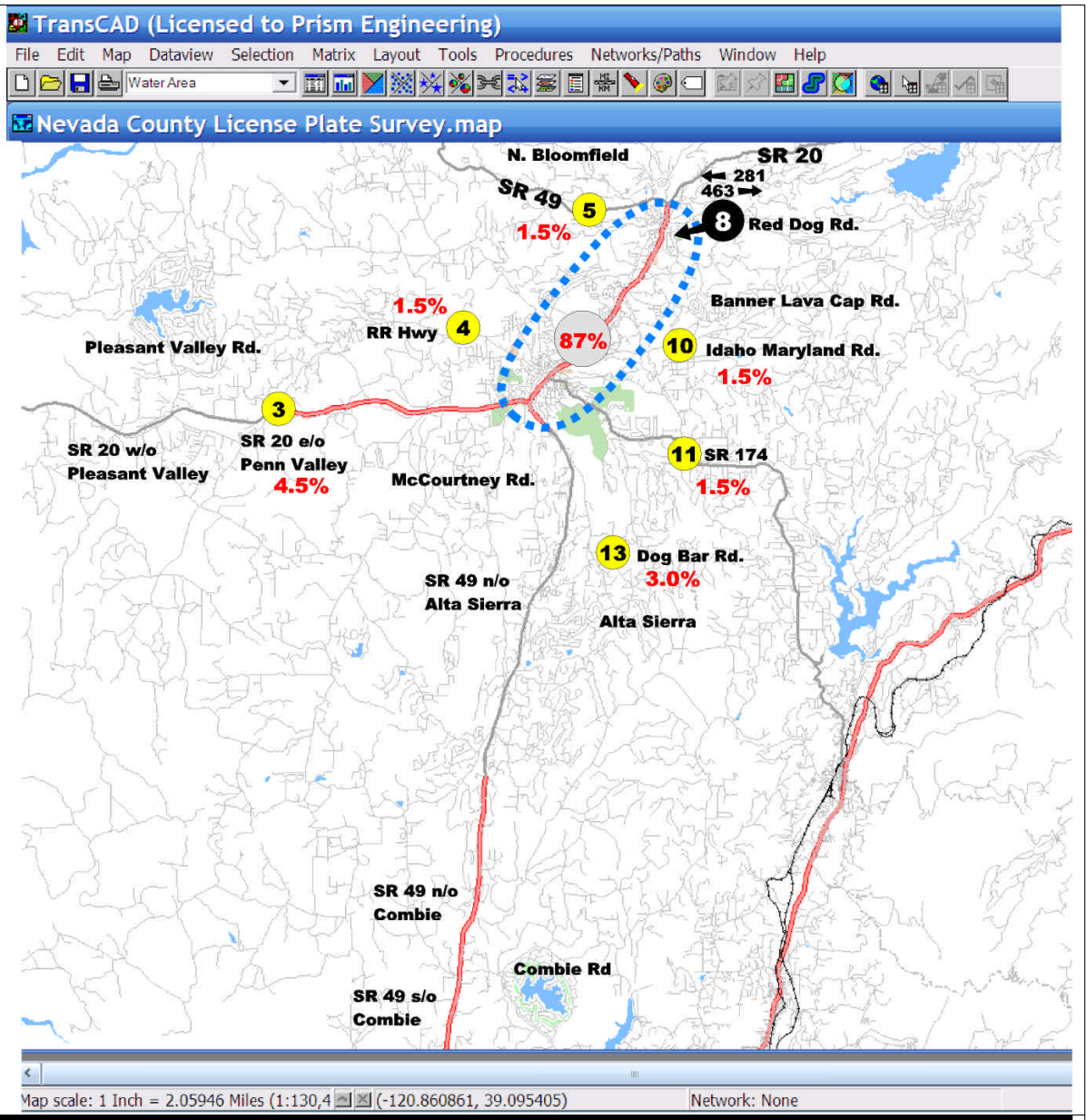


Figure 9 Survey Summary Station No. 8

A video camera operator captured license plate data for Survey Summary Station No. 8 along Boulder Street in Nevada City, and was positioned just east of Park Avenue facing west. Both directions were captured.

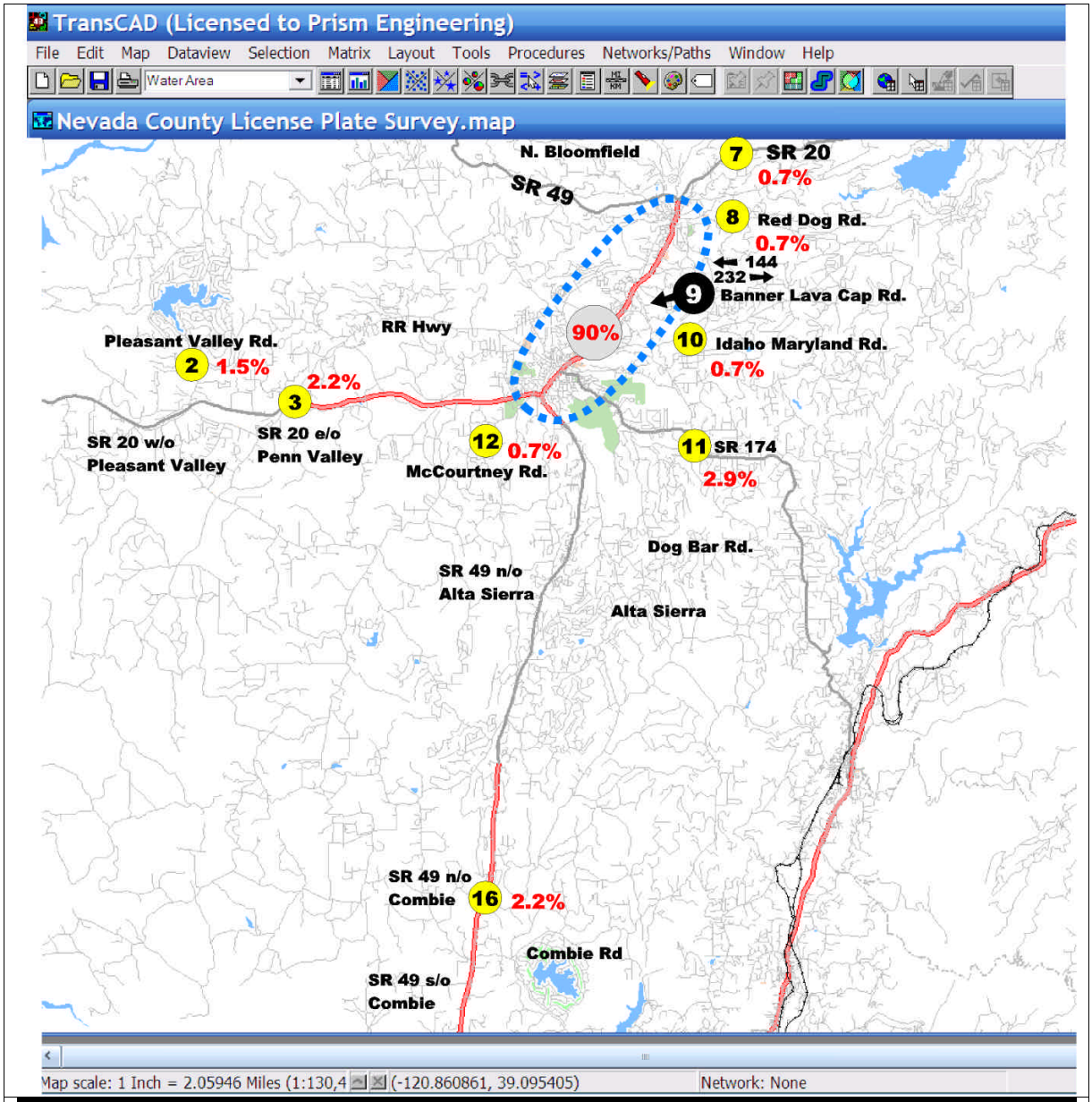


Figure 10 Survey Summary Station No. 9

A video camera operator captured license plate data for Survey Summary Station No. 9 along Banner Lava Cap Road, and was positioned just east of the SR 20/49 bridge facing west (approximately 300 feet east of Ridge Road). Both directions were captured.

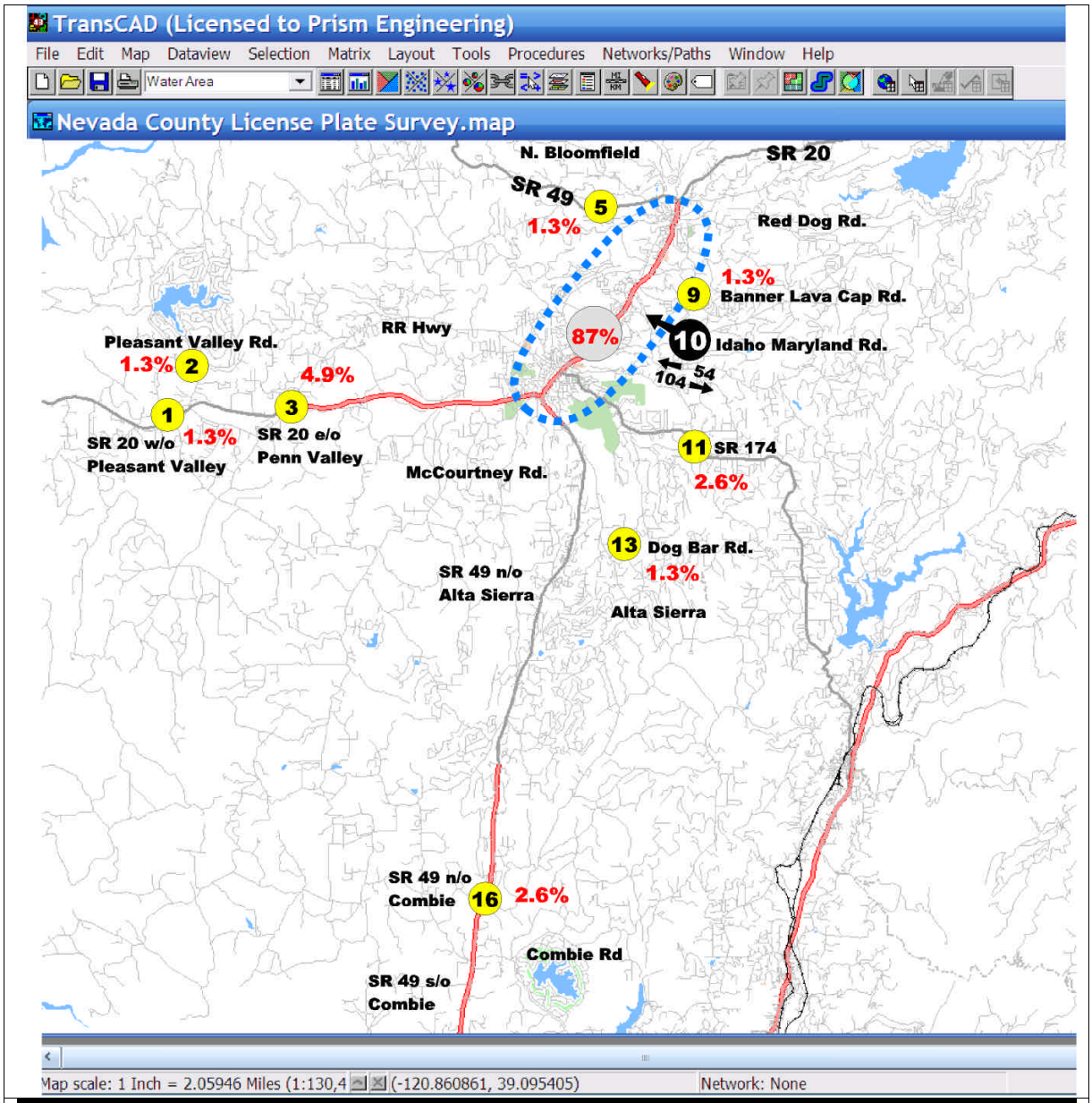


Figure 11 Survey Summary Station No. 10

A video camera operator captured license plate data for Survey Summary Station No. 10 along Idaho Maryland Road, and was positioned approximately 300 feet east of Brunswick Road facing west. Both directions were captured.

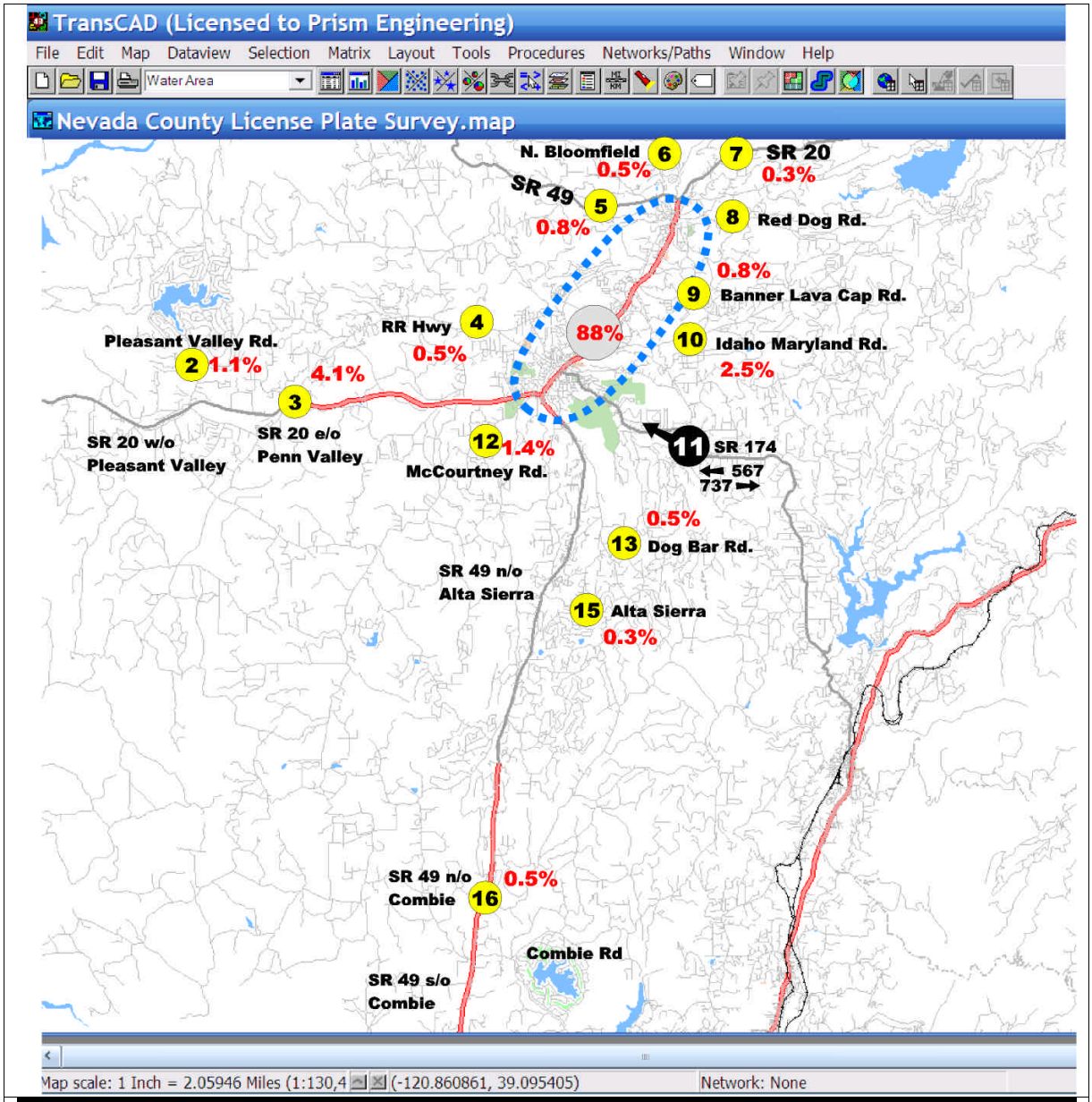


Figure 12 Survey Summary Station No. 11

A video camera operator captured license plate data for Survey Summary Station No. 11 along SR 174, and was positioned just south of Brunswick Road facing south. Both directions were captured.

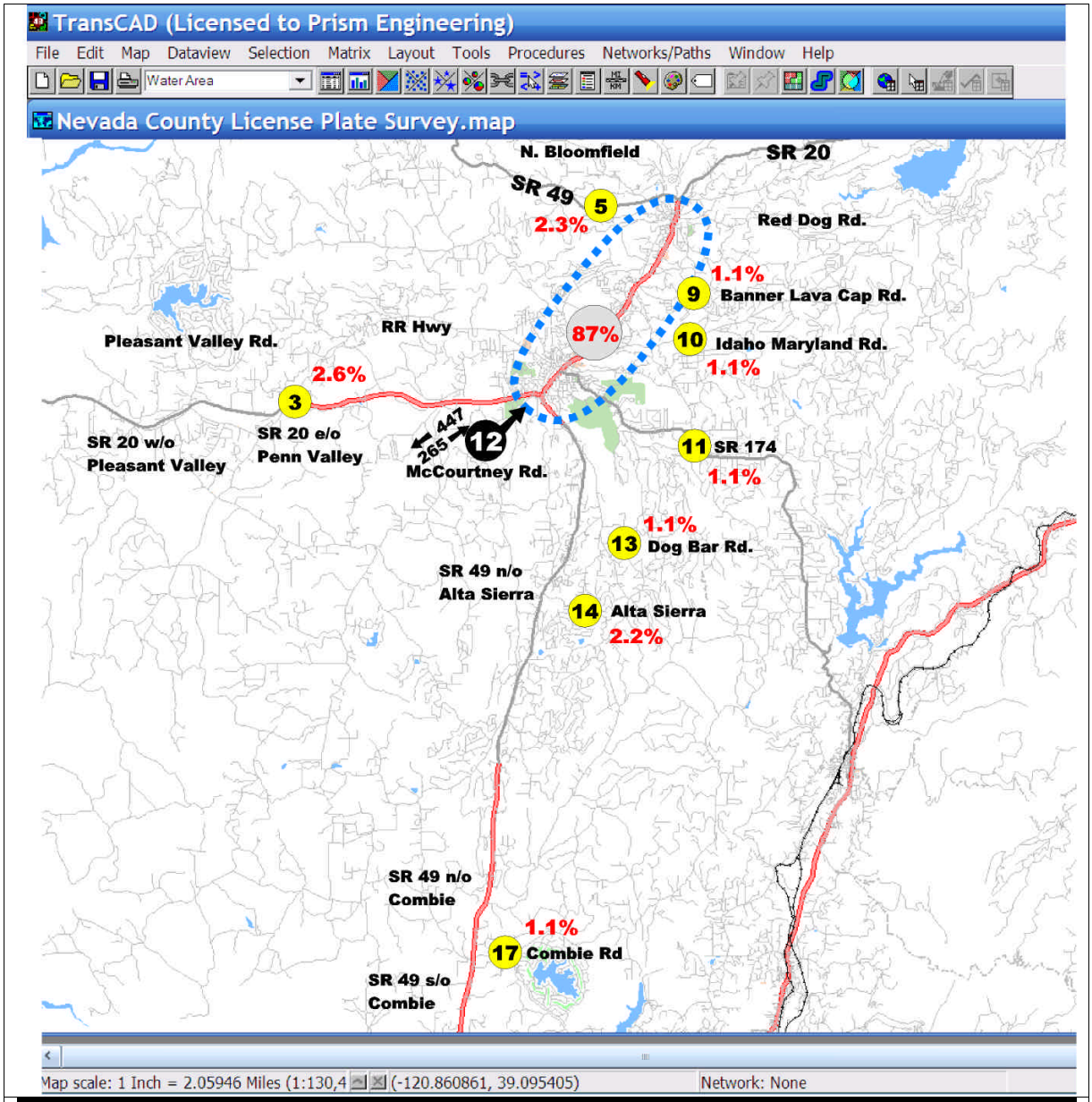


Figure 13 Survey Summary Station No. 12

A video camera operator captured license plate data for Survey Summary Station No. 12 along Mc Courtney Road, and was positioned just east of Old Auburn Road facing west. Both directions were captured.

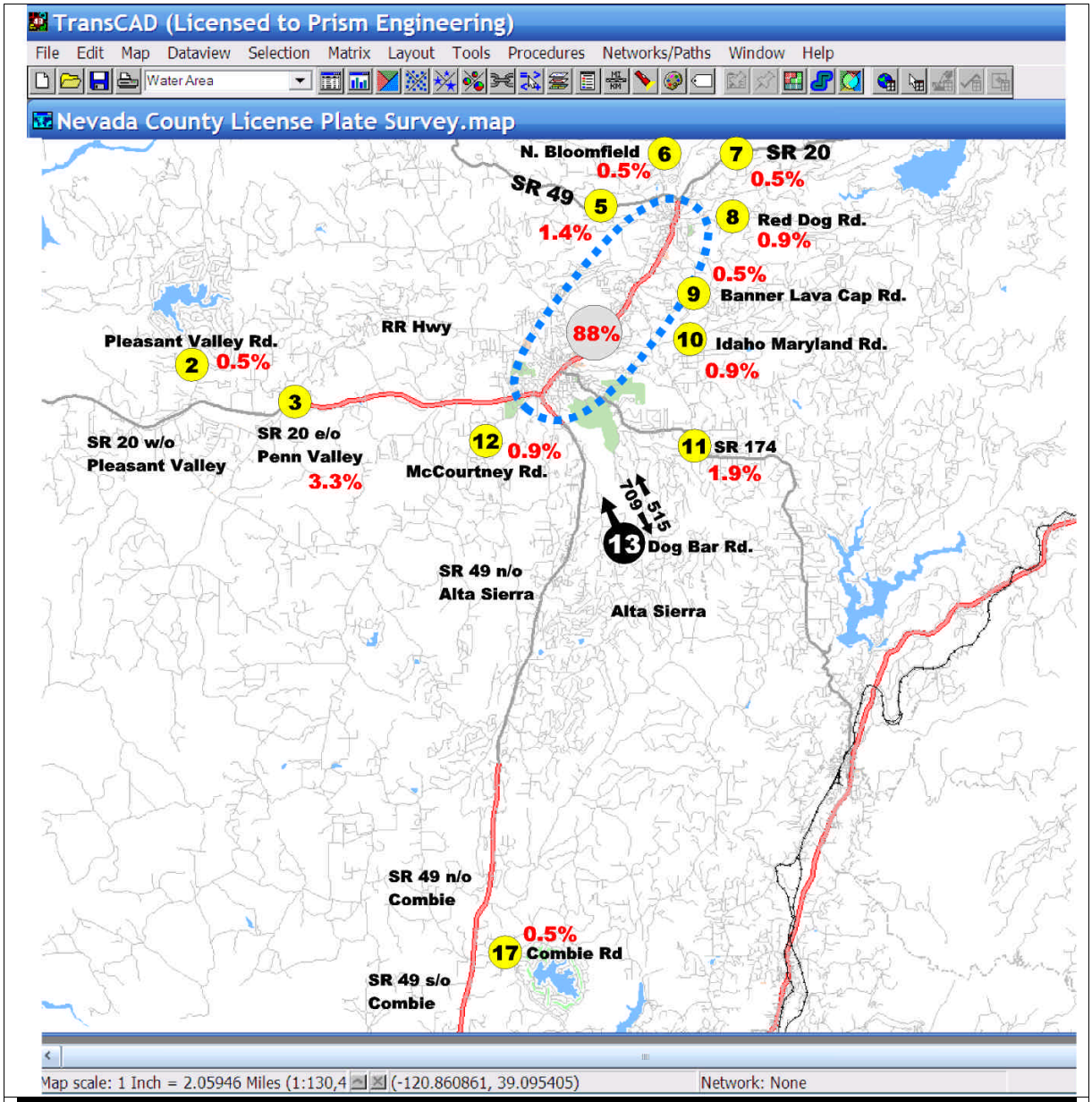


Figure 14 Survey Summary Station No. 13

A video camera operator captured license plate data for Survey Summary Station No. 13 along Dog Bar Road, and was positioned just south of La Barr Meadows Road facing south. Both directions were captured.

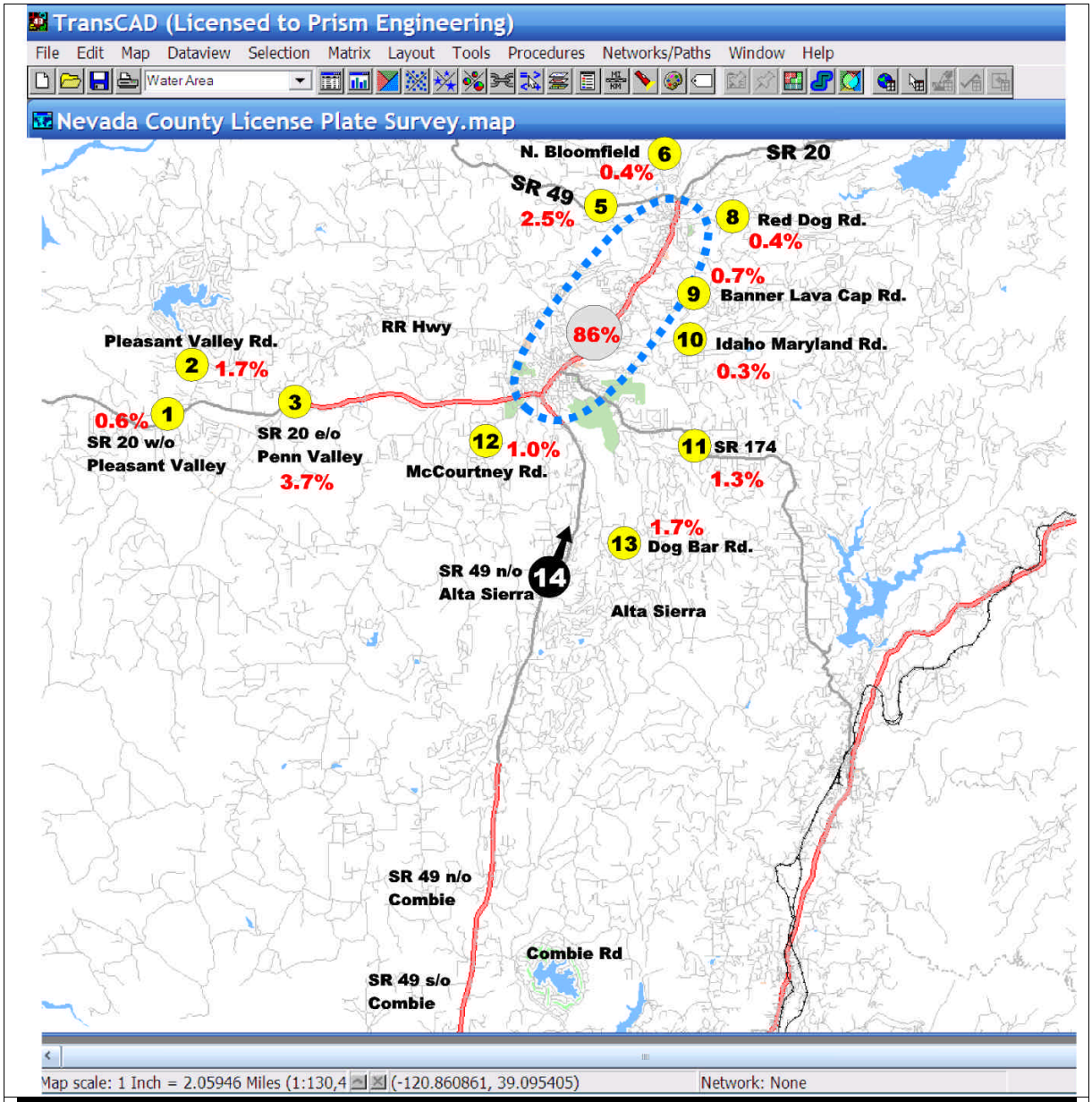


Figure 15 Survey Summary Station No. 14

Two video camera operators captured license plate data for Survey Summary Station No. 14 along SR 49, and were positioned just north of Alta Sierra Drive, one facing south and the other facing north. Both directions of traffic were captured.

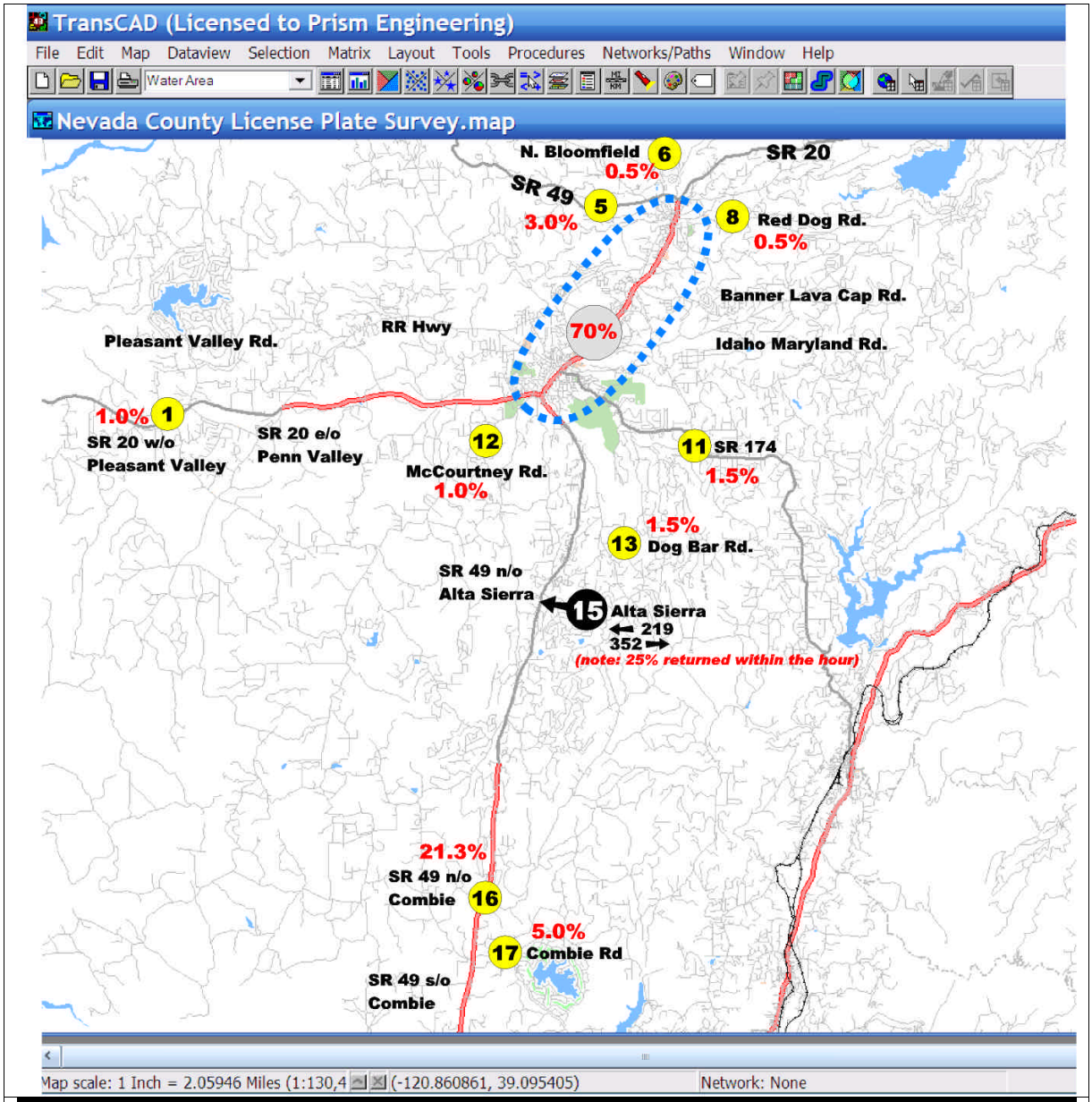


Figure 16 Survey Summary Station No. 15

A video camera operator captured license plate data for Survey Summary Station No. 15 along Alta Sierra Drive, and was positioned approximately 300 feet east of SR 49 facing east. Both directions were captured. 25.2% of vehicles surveyed heading west to SR 49 returned within the hour.

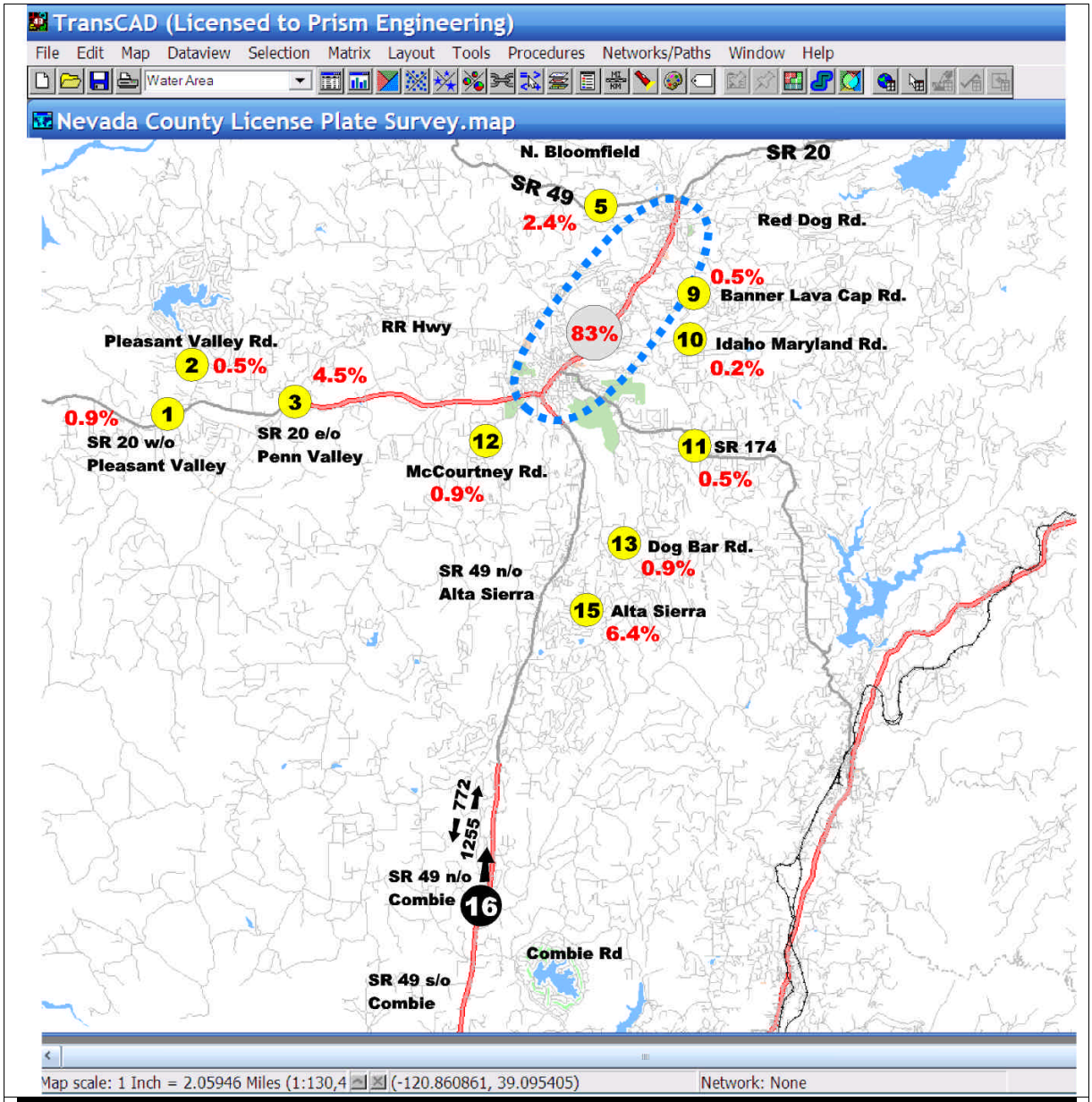


Figure 17 Survey Summary Station No. 16

Two video camera operators captured license plate data for Survey Summary Station No. 16 along SR 49, and were positioned just south of Brewer Road, one camera facing north, the other facing south. Both directions were captured.

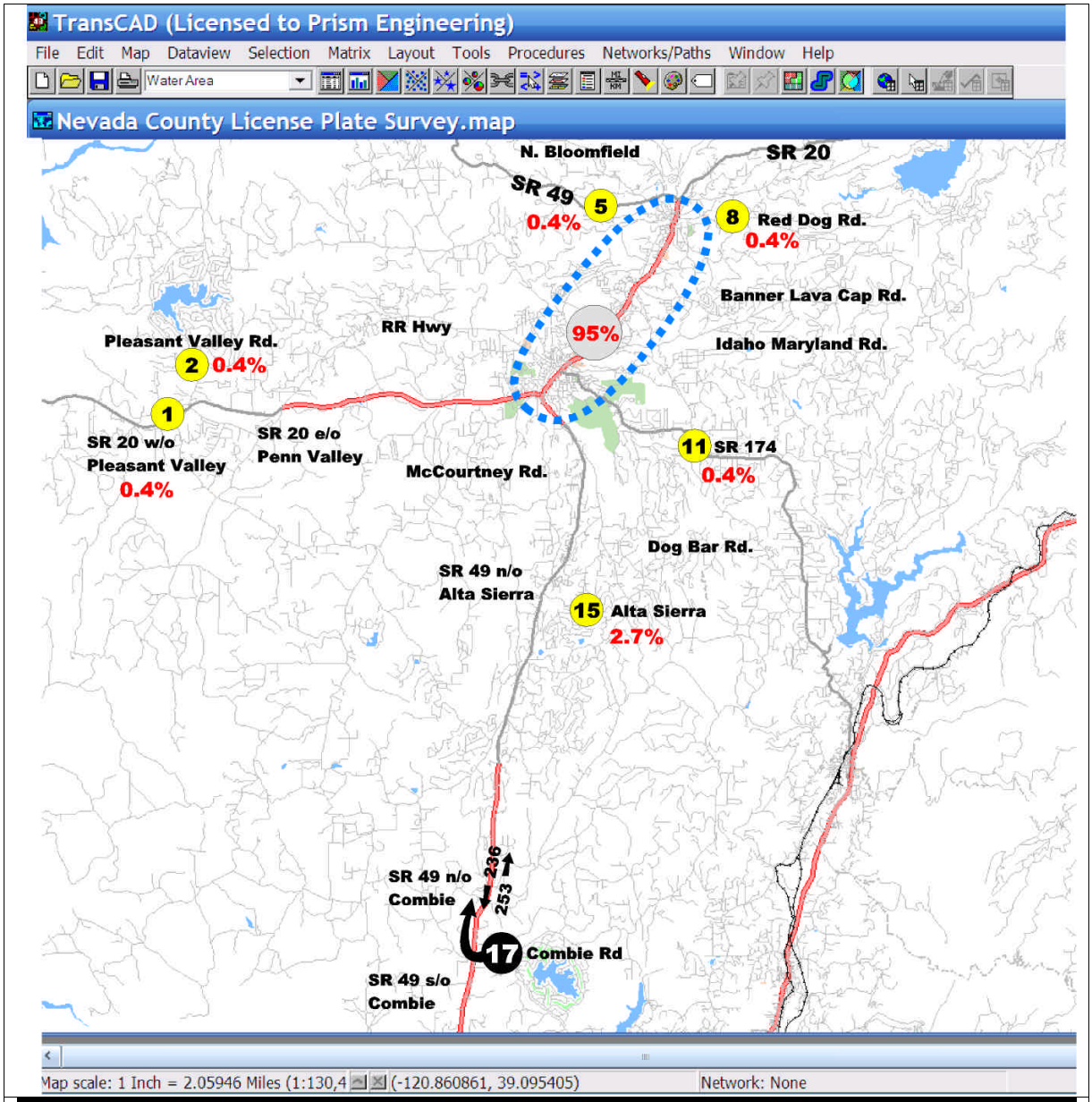


Figure 18 Survey Summary Station No. 17

Two video camera operators captured license plate data for Survey Summary Station No. 17 along Combie Road, and were positioned just east of the Longs shopping center east exit, one camera facing west, the other facing east. Both directions were captured. The percentages in the figure represents the trips that were westbound on Combie Road and also turned north onto SR 49.

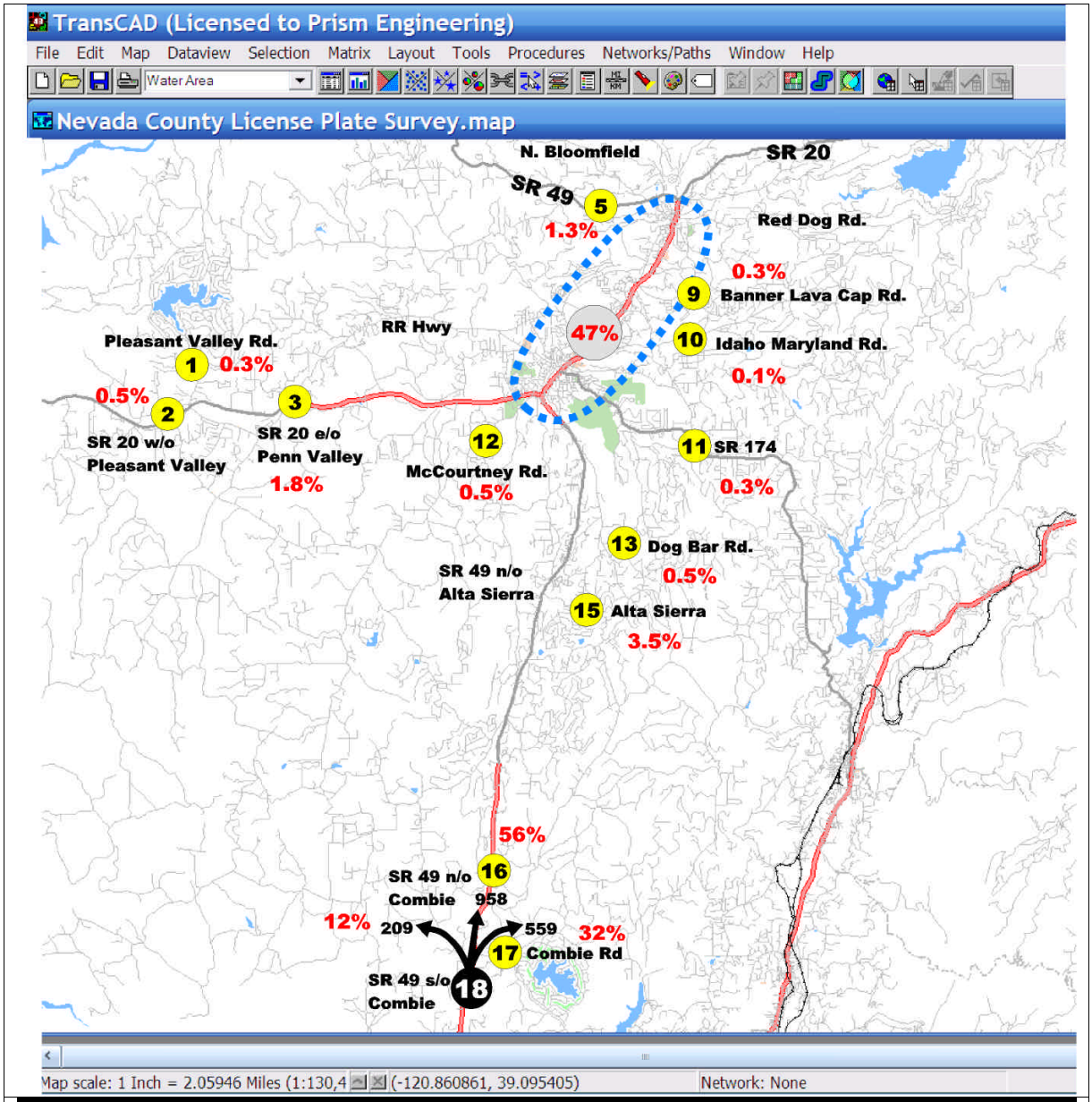


Figure 19 Survey Summary Station No. 18

Based on the trip distribution from the Location 16 survey for SR 49 northbound traffic, and a recent pm peak hour turning movement count at the intersection of SR 49 and Combie Road, Figure 19 was prepared. No video camera(s) were employed at Location 18. 12% of SR 49 NB traffic at this location turned left onto Wolf Road.

Conclusions

The results of this study indicate that the majority (85%) of “external” trips traveling from the rural areas of Nevada County, (Alta Sierra, Penn Valley, Lake of the Pines, etc.) enter Fee Zone 8 during the pm peak hour. The trips that enter Fee Zone 8 from the rural County represent 29% of the traffic taking place within Fee Zone 8 during the pm peak hour. The total destination trips within Fee Zone 8 was 14,194 (see Table 2), and 4,176 (29%) of these began in the rural area of the County (Fee zones 2-7).

Across the entire area, 15% of the rural-based trips either pass through or do not have a destination within the Grass Valley/ Nevada City area (Fee Zone 8).

This recently collected data could be used to support a change in the Regional Mitigation Fee structure so that the total of fees from zones 2-7 is 29% of the "average" fee, rather than the 21% used before the field data was available.

If you have any questions, or if further information is needed, please do not hesitate to call.

Sincerely,
PRISM Engineering

Grant P. Johnson, PE, PTOE
Principal